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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	20003
First Inventor or Application Identifier	Paul Woskov
Title	Gas Processing for Waste Treatment Unit Having Combined Joule and Arc Heating
Express Mail Label No.	EJ420174505US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [x] * Fee Transmittal Form *(e.g., PTO/SB/17)* *(Submit an original and a duplicate for fee processing)*
2. [x] Specification [*Total Pages* ☐]
   (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [x] Drawing(s) *(35 U.S.C. 113)* [*Total Sheets* 2]
4. Oath or Declaration [*Total Pages* 2]
   a. [x] Newly executed (original or copy)
   b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

** NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).*

ADDRESS TO: Assistant Commissioner for Patents
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Washington, DC 20231

5. ☐ Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. ☐ Computer Readable Copy
   b. ☐ Paper Copy (identical to computer copy)
   c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [x] Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* ☐ Power of Attorney
9. ☐ English Translation Document *(if applicable)*
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. [x] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [x] * Small Entity Statement(s) *(PTO/SB/09-12)* ☐ Statement filed in prior application, Status still proper and desired
14. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
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16. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
    ☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____/_____
    Prior application information: Examiner _____ *Group / Art Unit:* _____
    For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

☐ *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [x] *Correspondence address below*

Name	Douglas E. McKinley, Jr. Integrated Environmental Technologies, LLC				
Address	1935 Butler Loop				
City	Richland	*State*	WA	*Zip Code*	99352
Country	U.S.A.	*Telephone*	(509) 946-9619	*Fax*	(509) 946-1819

Name (Print/Type)	Douglas E. Mckinley, Jr.	*Registration No. (Attorney/Agent)*	40,280
Signature		*Date*	6-12-00

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PATENT

File No. 20003

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant or Patentee: Paul Woskov, David Y. Rhee, David A. Lamar, and Jeffrey E. Surma

Serial or Patent No.: _____

Filed or Issued: _____

For: GAS PROCESSING FOR WASTE TREATMENT UNIT HAVING COMBINED JOULE AND ARC HEATING ELECTRODE

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(d)) -

I hereby declare that I am an official empowered to act on behalf of the entity identified below:

NAME OF ORGANIZATION Integrated Environmental Technologies, LLC

ADDRESS OF ORGANIZATION 1935 Butler Loop, Richland, WA 99352

TYPE OF ENTITY:

[ ] Nonprofit Organization (37 CFR 1.9(e))
Nonprofit Scientific or Educational Under Statute of State of the United States of America
(Name of State _____)
(Citation of Statute _____)

[x] Small Business (37 CFR 1.9(d))
[ ] Independent Inventor (37 CFR 1.9(c))

I hereby declare that the entity identified above qualifies as such as defined in [ ]37 CFR 1.9(c) [x]37 CFR 1.9(d) [ ]37 CFR 1.9(e) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code with regard to the invention entitled GAS PROCESSING FOR WASTE TREATMENT UNIT HAVING COMBINED JOULE AND ARC HEATING ELECTRODE by inventor(s) Paul Woskov, David Y. Rhee, David A. Lamar, and Jeffrey E. Surma described in

[ ] application executed _____

[X] specification filed herewith

[ ] application serial no. _____, filed _____

[ ] patent no. _____, issued _____.

I hereby state that rights under contract or law have been conveyed to and remain with entity with regard to the above identified invention.

If the rights held by such entity are not exclusive, each individual, concern or organization having rights in the invention must file separate statements as to their status as small entities (37 CFR 1.27) and that no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization having any rights in the invention is listed below:

NAME _____
ADDRESS _____
[ ] INDEPENDENT INVENTOR [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

NAME _____
ADDRESS _____
[ ] INDEPENDENT INVENTOR [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Jeffrey E. Surma
TITLE OF ORGANIZATION President & CEO
Integrated Environmental Technologies, LLC
ADDRESS OF PERSON SIGNING 1935 Butler Loop, Richland, WA 99352

SIGNATURE _____ DATE 6-6-00

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Patent

IET- 20003

GAS PROCESSING FOR WASTE TREATMENT UNIT HAVING COMBINED JOULE AND ARC HEATING ELECTRODE

FIELD OF THE INVENTION

The present invention relates generally to apparatus for the processing of gas produced in hazardous waste treatment systems. More specifically, the present invention relates to the use of microwave energy to process water vapor, organic gasses, and carbon particles produced in high temperature waste treatment systems.

BACKGROUND OF THE INVENTION

Concerns associated with the long term fate of wastes and drawbacks associated with current waste disposal methods have led to a variety of different systems designed for the treatment and stabilization of those wastes. Systems which handle a wide variety of waste streams and which produce useful and/or benign products with a minimum amount of secondary waste streams are particularly preferred. Several schemes for achieving these desired ends have been proposed. High temperature systems which destroy waste by converting the inorganic portion of the waste into stable glasses and the organic portion of the waste into a useful synthesis gas are particularly notable. Many of these systems utilize plasmas to generate the high temperatures necessary to form stable, leach resistant glasses and to achieve the gaseous reactions necessary to form useful products such as synthesis gas from organic feed streams.

Plasmas are high temperature, ionized gasses which provide rapid and efficient heat transfer. The ability of plasmas to rapidly transfer heat to incoming organic feedstocks allows the plasma to simultaneously pyrolize the

organic feedstocks and provide the thermal energy to drive the endothermic steam reforming reactions of the pyrolyzed organic feedstocks. This dual benefit has been deployed with great success in systems utilizing plasmas including those described in U.S. Patent 5,666,891, titled "Arc Plasma-Melter Electro Conversion System for Waste Treatment and Resource Recovery" to Titus et al. and which the entire contents are incorporated herein by reference, which shows a variety of particularly useful configurations wherein arc electrodes which produce the plasma are used in systems in various combinations with joule heating electrodes. In these arrangements, organic compounds contained in the waste are destroyed by pyrolysis, caused by the high temperatures of the plasma breaking the chemical bonds of the organic molecules. By introducing steam into the process chamber, these pyrolyzed organic constituents are converted into synthesis gas, a clean burning fuel consisting primarily of CO, CO_2 and H_2, through the steam reforming reaction. Other constituents of the waste, which are able to withstand the high temperatures without becoming volatilized, are made to form into a molten state which then cools to form a stable glass. By carefully controlling the vitrification process, the resulting vitrified glass may be made to exhibit great stability against chemical and environmental attack, with a high resistance to leaching of the hazardous components bound up within the glass. In this manner, these waste treatment systems may be utilized to convert waste materials into a high quality synthesis gas and a stable, environmentally benign, glass.

While systems utilizing plasma present significant advantages over prior art waste treatment systems, there still exist certain drawbacks related to the incomplete formation of CO, CO_2 and H_2, through the steam reforming reactions. In particular, plasma and other high temperature systems will occasionally fail to completely convert organic feedstocks into of CO, CO_2 and H_2, through steam reforming reactions. Typically, incomplete conversion is a result of a failure to either raise the materials to a sufficient temperature to bring about these reactions, or a failure to hold the materials at these high

temperatures for a sufficient period of time to allow complete conversion. The incomplete conversion of the gasses and carbon particles adds to the cost of these systems, as equipment must be provided to treat or remove the organic gasses and carbon particles in the off gas of these systems. Thus, their exists a need for a method and apparatus which promotes the conversion of carbon particles, organic gasses and steam into CO, CO_2 and H_2, through steam reforming reactions.

SUMMARY OF THE INVENTION

The present invention is a method and apparatus for treating gasses having carbon particles, organic gasses, and steam. The present invention makes use of microwave electromagnetic radiation in the frequency range of 0.5–30 GHz to provide additional heat to a thermal reformer chamber placed in the exhaust path of a high temperature treatment system. The microwaves increase the thermal energy of the exhaust by one or both of two mechanisms. The first mechanism is direct heating of the molecular species in the exhaust by absorption of the microwaves by individual molecules. Molecules that have a dipole moment (a nonuniform distribution of positive and negative charge) such as H_2O will be agitated by oscillating electric field of the microwaves to higher kinetic energies, thus heating the gas. The second mechanization is breakdown of the exhaust gas into a plasma by the microwaves, which are in turn strongly absorbed by free electrons in the plasma. The plasma thermal energy is then efficiently transferred by electron-molecule collisions. The presence of carbon particulates in the exhaust gas greatly facilitates the plasma breakdown mechanism by lowering the microwave power density at which plasma breakdown will occur. Loosely bound electrons of electrically conductive particles such as carbon are freed by sufficiently strong microwave electric fields to initiate plasma breakdown. The localized breakdown on or near the graphite or carbon particles will enhance the conversion of carbon to carbon monoxide. The energy of the microwaves will be concentrated on or near the carbon particle surface which is the location where the desired heterogeneous reaction between the oxidant and the carbon occurs. As

previously described, the oxidant is typically steam or carbon dioxide, but the present invention should be understood to encompass other sources of oxygen. The use of microwaves to provide direct energy thus act synergistically to react carbon with steam in that the water molecule is selectively heated by the microwaves and the carbon particle is indirectly heated in a selective manner due to localized breakdown on or near the carbon particle surface.

OBJECTS

Accordingly, it is an object of the present invention to provide a method and apparatus for treating gasses having carbon particles, organic gasses, and steam.

It is a further object of the present invention to provide a method of treating a gas stream containing an oxidant and carbon particles by introducing the gas stream into a processing chamber, and exposing the gas stream to microwave energy having a sufficient power and for a sufficient period of time to induce the carbon to react with the oxidant.

It is a further object of the present invention to provide a method of treating a gas stream containing carbon particles utilizing steam and/or carbon dioxide as the oxidant.

It is a further object of the present invention to provide a method of treating a gas stream by providing microwave energy at a frequency between 500 MHz and 30 GHz.

It is a further object of the invention to provide a gas processing chamber for treating a gas stream containing an oxidant and carbon particles having a gas inlet port for receiving the gas stream from a high temperature processing chamber, a gas outlet port for exhausting the processed gas stream, a microwave source for introducing microwave energy into the gas processing chamber having a sufficient power to induce the carbon to react with the oxidant, a microwave waveguide to direct the microwave energy at the gas stream for processing, a reflected microwave power dump for protecting the microwave

source from reflected microwave power, and a window seal to separate the gas stream from the microwave source.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig 1. is a schematic of the apparatus of a first preferred embodiment of the present invention.

Fig 2. is a schematic of the apparatus of a second preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT (S)

The nature and operation of the present invention is illustrated by the following description of two preferred embodiments. The invention should in no way be limited to the specific example set forth in this description of the preferred embodiment; rather, it is presented merely to illustrate preferred and acceptable methods of practicing the present invention. In the various figures setting forth the features of the present invention, like numerals refer to like elements.

<u>Details of Preferred Embodiment</u>

The basic details of a first preferred embodiment of the present invention are shown in Figure 1. A gas processing chamber **1**, or thermal residence chamber (TRC), is a large, preferably metallic, enclosure having an input pipe **2** for the exhaust from the furnace, an output pipe **3** for the processed gases, and an input waveguide **4** for the microwaves. The TRC **1** is preferably constructed from an electrically conducting metal such as steel to reflectively trap microwaves that are not absorbed on the first pass through the exhaust gases. Also, the maximum aperture of the input **2** and output pipes **3** and other ports except for the waveguide port **5** preferably do not exceed approximately 40% of the microwave wavelength to trap the radiation inside the TRC **1**. For a microwave frequency of 915 MHz this would correspond to a maximum aperture of approximately 13.0

cm (5.1"). Larger gas flow through areas can be achieved by combining a number of smaller pipes in parallel (not shown) or using a metallic grate inside a larger duct (not shown) where temperatures are low enough for such an implementation.

The microwaves are coupled to the TRC **1** by a standard metallic waveguide **4**. For example, at 915 MHz this could be a WR-975 waveguide with an inside rectangular cross section of 9,750 x 4.875 inches (24.8x12.4 cm). A suitable distance away from the TRC **1,** to insure cleanliness, the waveguide **4** is preferably sealed by a microwave transparent window **6** such as a high purity alumina ceramic plate. The edges of the window **6** can be cooled by water flow (not shown) and an inert gas flow such as nitrogen **13** blown across the window **6** side facing the TRC **1** to further insure the window **6** remains clean.

Microwaves are preferably generated by a magnetron microwave tube **7** which in turn is powered by an electrical power supply **8** which provides a low voltage for the heater filament and a high voltage for the anode. Nominal voltages are approximately 12 volts for the filament and 6,000 volts for the anode. At the microwave output of the magnetron **7** there is a microwave detector **9** for monitoring microwave power levels directed toward the TRC **1**.

A microwave waveguide circulator **10** is connected to the magnetron **7** output to prevent microwave reflected power from reaching the magnetron **7**. The circulator **10** is a standard microwave component that directs forward power from the magnetron **7** toward the TRC **1** and reflected power from the TRC **1** toward a microwave dump **11** as indicated by a reflected power detector **15**. The +- microwave dump **11** absorbs the reflected power and subsequent heat is dissipated into a water-cooling line **14**. The power ratings of the reflected power dump **11** and circulator **10** should be sufficient to handle the microwave power output of the magnetron **7**. In the case where plasma breakdown is achieved inside the TRC **1** with the microwave source, the gas flow velocity will be of sufficient magnitude to blow the plasma away from the waveguide **4** into the TRC **1** and away from the TRC **1** walls. This may be accomplished by locating the microwave input **5** close to the exhaust gas input **2** where gas flow velocity is

maximum, by a addition gas jets (not shown) near the inside TRC **1** walls, and by sufficient gas flow in the microwave waveguide **13** toward the chamber.

A further embodiment of the microwave assisted TRC **1** would make use of multiple microwave power sources **16** as shown in Figure 2. A microwave modular unit **16** would contain all the components shown in Figure 1 on the microwave power side of the window seal **6**. This design would make economical use of standard commercially available microwave sources to increase the maximum microwave power for additional heating in the TRC **1**. For example, a standard power increment for 915 MHz is 75 kW, by combining four sources a total microwave heating power of 300 kW could be achieved. Higher heating power could be achieved with more units. The modular construction shown in Figure 2 would also improve reliability and ease maintenance. One unit could be serviced or replaced without interrupting TRC operations.

While a preferred embodiment of the present invention has been shown and described, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the invention in its broader aspects. All such configurations are thus considered within the contemplation of the present invention, and the appended claims are therefore intended to cover all such changes and modifications which fall within the true spirit and scope of the invention.

CLAIMS

I claim:

1. A method of treating a gas stream containing an oxidant and carbon particles comprising the steps of:
   a) introducing the gas stream into a processing chamber,
   b) exposing the gas stream to microwave energy having a sufficient power and for a sufficient period of time to induce the carbon to react with the oxidant.
2. The method of **claim 1** wherein the oxidant is selected from the group consisting of steam and carbon dioxide.
3. The method of **claim 1** wherein the microwave energy is provided at a frequency between 500 MHz and 30 GHz.
4. A gas processing chamber for treating a gas stream containing an oxidant and carbon particles comprising:
   a) a gas inlet port for receiving the gas stream from a high temperature processing chamber,
   b) a gas outlet port for exhausting the processed gas stream, and
   c) a microwave source for introducing microwave energy into the gas processing chamber having a sufficient power to induce the carbon to react with the oxidant.
5. The gas processing chamber of **claim 1** further comprising a microwave waveguide to direct the microwave energy at the gas stream for processing.
6. The gas processing chamber of **claim 1** further comprising a reflected microwave power dump for protecting the microwave source from reflected microwave power.
7. The gas processing chamber of **claim 1** further comprising a window seal to separate the gas stream from the microwave source.

ABSTRACT

A gas processing chamber for treating a gas stream containing an oxidant and carbon particles, having a gas inlet port for receiving the gas stream from a high temperature processing chamber, a gas outlet port for exhausting the processed gas stream, a microwave source for introducing microwave energy into the gas processing chamber having a sufficient power to induce the carbon to react with the oxidant, a microwave waveguide to direct the microwave energy at the gas stream for processing, a reflected microwave power dump for protecting the microwave source from reflected microwave power, and a window seal to separate the gas stream from the microwave source.

Figure 1

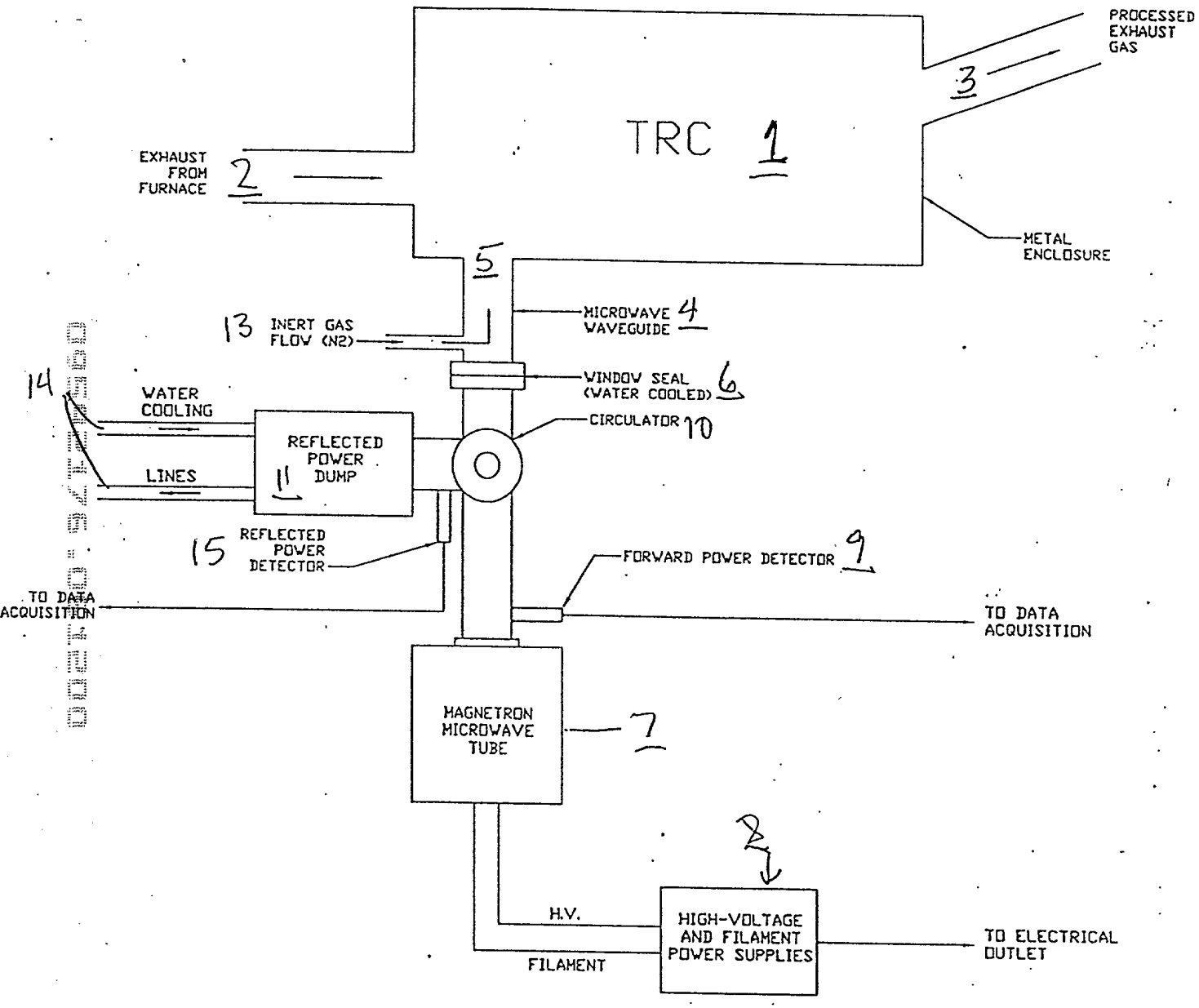

FIGURE 1. MICROWAVE ASSISTED THERMAL RESIDENCE CHAMBER BASIC DETAILS.

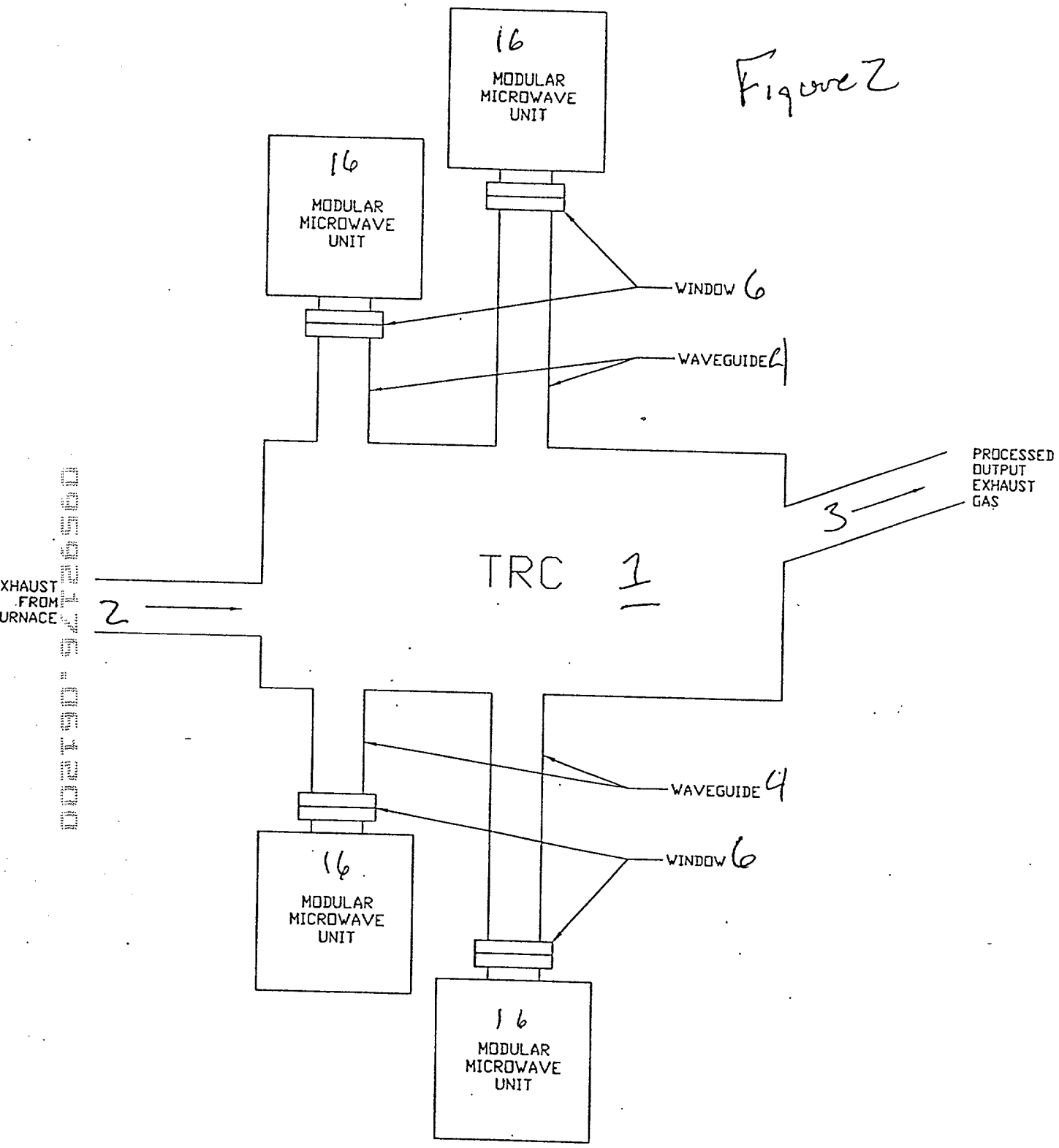

Figure 2

FIGURE 2. A MICROWAVE ASSISTED THERMAL REFORMER CHAMBER WITH MODULAR MICROWAVE HEATING UNITS.

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PATENT

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COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name,

I believe I am the original, first, and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled GAS PROCESSING FOR WASTE TREATMENT UNIT HAVING COMBINED JOULE AND ARC HEATING ELECTRODE, the specification of which

[X] is attached hereto.

[ ] was filed on _____ as Application Serial No. _____

[ ] and was amended on _____ (if applicable)

[ ] with amendments through _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Sec. 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Sec. 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

[X] no such applications have been filed

[ ] such applications have been filed as follows

Prior Foreign Application(s)			Priority Claimed	
NONE				
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No

I hereby claim the benefit under Title 35, United States Code, Sec. 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Sec. 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Sec. 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

NONE

(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application, to file a corresponding international application, and to transact all business in the Patent and Trademark Office connected therewith:

Douglas E. McKinley, Jr. Registration No. 40,280

Address all correspondence to:

Douglas E. McKinley, Jr.
Integrated Environmental Technologies, LLC
1935 Butler Loop
Richland, WA 99352

Direct all phone calls to him at (509) 946-9619

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole inventor Paul Woskov

Inventor's signature Paul Woskov 5/30/00
Date

Residence Bedford, MA 01730

Citizenship U.S.A.

Post Office address 4 Ledgewood Drive, Bedford, MA 01730

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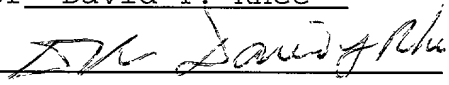
Full name of sole inventor David Y. Rhee

Inventor's signature  5/30/2000
Date

Residence Chestnut Hill, MA 02467

Citizenship U.S.A.

Post Office address 40 Princeton Road, Chestnut Hill, MA 02467

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PATENT

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[X] no such applications have been filed

[ ] such applications have been filed as follows

Prior Foreign Application(s) | Priority Claimed

NONE

(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No

I hereby claim the benefit under Title 35, United States Code, Sec. 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Sec. 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Sec. 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

NONE

(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application, to file a corresponding international application, and to transact all business in the Patent and Trademark Office connected therewith:

Douglas E. McKinley, Jr. Registration No. 40,280

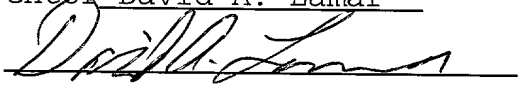
Address all correspondence to:

Douglas E. McKinley, Jr.
Integrated Environmental Technologies, LLC
1935 Butler Loop
Richland, WA 99352

Direct all phone calls to him at (509) 946-9619

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole inventor David A. Lamar

Inventor's signature  6-5-00
Date

Residence West Richland, WA 99352

Citizenship U.S.A.

Post Office address 5417 Fern Loop, West Richland, WA 99352

Express Mailing Label #EJ420174505US

PATENT

File No. 20003

COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name,

I believe I am the original, first, and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled GAS PROCESSING FOR WASTE TREATMENT UNIT HAVING COMBINED JOULE AND ARC HEATING ELECTRODE, the specification of which

[X] is attached hereto.

[ ] was filed on _____ as Application Serial No. _____

[ ] and was amended on _____ (if applicable)

[ ] with amendments through _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Sec. 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Sec. 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

[X] no such applications have been filed

[ ] such applications have been filed as follows

Prior Foreign Application(s)			Priority Claimed	
		NONE		
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Number)	(Country)	(Day/Month/Year Filed)	[ ] Yes	[ ] No

I hereby claim the benefit under Title 35, United States Code, Sec. 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Sec. 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Sec. 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

NONE

(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)

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Full name of sole inventor Jeffrey E. Surma

Inventor's signature [signature] 6-6-00
Date

Residence Richland, WA 99352

Citizenship U.S.A.

Post Office address 147 Meadow Hill Drive, Richland, WA 99352